REMARKS

The Office Action mailed February 26, 2008 and made final has been carefully reviewed and the following remarks have been made in consequence thereof.

Claims 1, 3-15, 17-29 are now pending in this application. Claims 1, 3-15, 17-29 stand rejected. Claims 2, 16, 30, and 31 have been canceled.

Initially, Applicants respectfully traverse the assertion at Page 6 of the instant Office Action that "[t]he cusp of the invention of Ford is using phase differences to determine the baseline, azimuth, pitch, etc. of the vehicle." Rather, Applicants respectfully submit that Ford describes a heading sensor (40) that includes a receiver (45) that receives positioning signals from six satellites via a primary antenna (41) and a secondary antenna (43). The heading sensor (40) produces six single-difference observations and uses differences in the carrier observations to generate a baseline (40). However, Ford does not describe nor suggest determining an accurate heading, accurate heading rate, attitude, and/or attitude rate of the locomotive during normal locomotive transit operations using only the set of phase differences between the satellite reference signals and the vector distance, as is recited in independent Claims 1 and 15 of the instant application. Rather, as described by Ford, the process of determining baseline (49) requires using User-supplied constraints that are input into a computational unit (60) in combination with the plurality of single-difference observations, due to unreliable ambiguity resolution caused by erroneous carrier measurements (Column 3, lines 30-35).

Applicants also respectfully traverse the assertion at Page 4 of the instant Office Action that "Gross et al. teach consulting a track database that provides track information as a function of latitude and longitude and that this information is used to limit measurement errors." Rather, Applicants respectfully submit that independent Claims 1 and 15 recite, "determining a vector distance $\vec{\mathbf{d}}$ between the two satellite signal receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude." In contrast to the recitations of Claims 1 and 15, Ford describes reducing the number of single-difference or double-difference candidates by imposing constraints on the baseline length, the pitch, the azimuth, or the velocity of the vessel or flight vehicle. Moreover, as illustrated in

Table I, Ford describes an example of a Pitch Constraint is whether the pitch is constrained by ± 10 degrees, a value that is unrelated to latitude or longitude. In further contrast to the recitations of Claims 1 and 15, Gross describes a database of information that pertains to rail routes that provide a way of converting elapsed distance from a known point along a known route to a location in two or three dimensional coordinates (Column 4, lines 35-41). Applicants respectfully submit that no combination of Ford's constraints and Gross' database of rail route information tied to elapsed distance traveled, describes nor suggests consulting a database that provides an initial heading and track grade as a function of latitude and longitude.

The rejection of Claims 1, 5-9, 12-15, 19-23, 28, and 29 under 35 U.S.C. § 103(a) as being unpatentable over Bidaud (U.S. Patent No. 6,347,265) in view of Ford (U.S. Patent No. 6,211,821) and in further view of Gross et al. (U.S. Patent No. 6,218,961) ("Gross") is respectfully traversed.

Bidaud describes a track analyzer that is coupled to a vehicle (28) traveling on a track (10). The analyzer includes a vertical gyroscope (20) for determining a grade and an elevation of the track. A rate gyroscope (50) determines a curvature of the track, and a speed determiner (70) determines a speed of the vehicle relative to the track. A distance determiner (91) determines a distance the vehicle has traveled along the track. The vehicle's heading is found by determining whether the phase of a first plate (112) leads/lags the phase of a second plate (114). Notably, Bidaud does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude.

Ford describes a navigation system (10) that uses satellite positional signals to determine pitch, azimuth and position of a vehicle. The navigation system (10) includes an integration unit (20) that receives a data (15) from a magnetic sensor (30) and data (17) from a heading sensor (40). The magnetic sensor is preferably a magnetic compass. The heading sensor (40) is preferably a single-axis attitude sensor that is used to acquire a positioning signal (13) from a satellite (11), such as a Global Positioning System (GPS) satellite. During periods when the satellite signal (13) is poor or unavailable, the intergation unit (20) continues to provide an azimuth output (19) via a built-in redundancy feature wherein data

(17) from the heading sensor (40) is used to correct data (15) from the magnetic sensor and the corrected data is used to ensure the integrity of the azimuth output (19). Notably, Ford does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, nor determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$.

Gross describes a proximity detection device for use in preventing collisions between railway vehicles and for providing proximity warnings or brake applications when a collision threat is detected. The device includes a processor (200), a display unit (210), an event recorder (230), and a human/machine interface (220) that can be used to receive inputs from a person controlling the vehicle. In operation, the processor (200) receives location data from vehicles on the railway system and compares that data to the location data for the vehicle on which it is installed (platform vehicle). Such a system could approximate a rail vehicle's location based on a track database (330) to within some range of error. The processor (200) analyzes the vehicle information and generates a warning which activates an alarm on the display unit (210) when a collision threat exists. The human/machine interface (220) allows the operator to acknowledge alarms and control the operation of the proximity detection system. The device determines the geographic location of the vehicle, i.e. the longitude and latitude of the vehicle, and transmits that information to a computer (300). If needed, the computer (300) converts the geographic location from the device (310) to a specific mile post number of the railway system based on the information retrieved from the track database (330). For additional accuracy, cross-checking and safety, the computer (300) may also receive inputs of the vehicle's direction of travel and velocity from vehicle sensors (340). Notably, Gross does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, nor determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$.

Claim 1 recites a method for determining motion and location parameters of a railroad locomotive wherein the method includes the steps of "providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive . . . determining a vector distance $\vec{\mathbf{d}}$ between the two satellite signal receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determining a set of phase differences between satellite reference signals received by satellite receivers . . . determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$."

No combination of Bidaud, Ford, and Gross, describes nor suggests, a method for determining motion and location parameters of a railroad locomotive as is recited in Claim 1. Specifically, none of Bidaud, Ford, or Gross, considered alone or in combination, describes or suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers and further determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, and Ford describes a process for determining a baseline (vector $\vec{\mathbf{r}}_o$) using carrier observations made at a primary antenna and a secondary antenna, in combination with user-supplied constraints.

Furthermore, at Page 4 of the instant Office Action, Applicants agree with the statement that, "Ford and Bidaud do not disclose the integer ambiguity is resolved by consulting a database that provides for an initial heading and track grade as a function of latitude and longitude." However, Applicants respectfully traverse the assertion that, "It would have been obvious to one of ordinary skill in the art to use the track database of Gross et al. in the invention of Ford and Bidaud because such modification would provide more accurate constraints." It is further stated that, "[i]n Ford, the constraint database is only rough

ranges, by using the track database of Gross et al., the measurement errors can be decreased and the constraints will be much more accurate than simple ranges." Applicants respectfully submit that even if this last statement was true, no combination of Ford, Bidaud, and Gross would describe nor suggest, consulting a database that provides for an initial heading and track grade as a function of latitude and longitude. Rather, and in contrast to the recitations of Claim 1, Bidaud describes storing, in a look-up table, parameters related to the vehicle and/or track that may include safety tolerances that, when exceeded, identify urgent defects, and curve elevation tolerances that, when exceeded, identify potentially unsafe curve elevations, but not the location of those curve elevations as a function of latitude and longitude. In further contrast to the recitations of Claim 1, Ford describes the use of user-supplied constraints, provided in the form of specific ranges, that may be stored in a memory, and Gross describes a database of information pertaining to rail routes that provide a way of converting elapsed distance from a known point along a known route into a location in two or three dimensional coordinates. Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Bidaud in view of Ford and further in view of Gross.

Claims 5-9, and 12-14 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 5-9, and 12-14 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 5-9, and 12-14 likewise are patentable over Bidaud in view of Ford and further in view of Gross.

Claim 15 recites an apparatus for determining motion and location parameters of a railroad locomotive to detect curves and reduce track wear, wherein the apparatus includes "at least two phase-locking satellite receivers configured to reference signals received from a set of satellites . . . a processor configured to . . . determine a set of phase differences between the reference signals received by said satellite receivers . . . determine a vector distance $\vec{d}$ between the two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude . . . determine an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the reference signals and the vector distance $\vec{d}$."

No combination of Bidaud, Ford and Gross describes nor suggests an apparatus for determining motion and location parameters of a railroad locomotive as is recited in Claim 15. Specifically, none of Bidaud, Ford or Gross, considered alone or in combination, describes or suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers and further determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$. Rather, in contrast to the present invention, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, and Ford describes a process for determining a baseline (vector $\vec{\mathbf{r}}_o$) using carrier observations made at a primary antenna and a secondary antenna, in combination with user-supplied constraints.

Furthermore, at Page 4 of the instant Office Action, Applicants agree with the statement that, "Ford and Bidaud do not disclose the integer ambiguity is resolved by consulting a database that provides for an initial heading and track grade as a function of latitude and longitude." However, Applicants respectfully traverse the assertion that, "It would have been obvious to one of ordinary skill in the art to use the track database of Gross et al. in the invention of Ford and Bidaud because such modification would provide more accurate constraints." It is further stated that, "[i]n Ford, the constraint database is only rough ranges, by using the track database of Gross et al., the measurement errors can be decreased and the constraints will be much more accurate than simple ranges." Applicants respectfully submit that even if this last statement was true, no combination of Ford, Bidaud, and Gross would describe nor suggest, consulting a database that provides for an initial heading and track grade as a function of latitude and longitude. Rather, and in contrast to the recitations of Claim 15. Bidaud describes storing in a look-up table parameters related to the vehicle and/or track that may include safety tolerances that, when exceeded, identify urgent defects, and curve elevation tolerances that, when exceeded, identify potentially unsafe curve elevations, but not the location of those curve elevations as a function of latitude and longitude. In further contrast to the recitations of Claim 15, Ford describes the use of user-supplied constraints, provided in the form of specific ranges, that may be stored in a memory,

and Gross describes a database of information pertaining to rail routes that provide a way of converting elapsed distance from a known point along a known route into a location in two or three dimensional coordinates. Accordingly, for at least the reasons set forth above, Claim 15 is submitted to be patentable over Bidaud in view of Ford and further in view of Gross.

Claims 19-23, 28, and 29 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 19-23, 28, and 29 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 19-23, 28, and 29 likewise are patentable over Bidaud in view of Ford and further view of Gross.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1, 5-9, 12-15, 19-23, 28, and 29 be withdrawn.

The rejection of Claims 3, 4, 17, and 18 under 35 U.S.C. § 103(a) as being unpatentable over Bidaud in view of Ford in view of Gross, as applied to Claims 1, 2, 15, and 16 above, and further in view of Wilson (U.S. Patent No. 6,313,788) is respectfully traversed.

Bidaud, Ford, and Gross are described above. Wilson describes a method for determining inter-antenna baselines using an antenna configuration (200) that includes a pair of relatively closely-spaced (D1) antennas and other pairs of distant (D2) antennas. The closely-spaced pair (D1) provides a short baseline that has an integer ambiguity that may be searched exhaustively to identify the correct set of integers. Specifically, as recited at Column 8, lines 40-43, "the exact number of cycles of the radio source carrier wave 310 may be used to reliably resolve the integer ambiguity 380 and thereafter determine the baseline." As such, Wilson describes using radio wave cycles to exhaustively search for and identify integer ambiguities. In contrast, the present invention describes determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, wherein an initial integer ambiguity is resolved by consulting a database that provides an initial heading and track grade as a function of latitude and longitude. Notably, Wilson does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers using an integer ambiguity, nor determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$.

Claim 1 is recited above.

No combination of Bidaud, Ford, Gross, and Wilson, describes nor suggests a method for determining motion and location parameters of a railroad locomotive, as is recited in Claim 1. Specifically, none of Bidaud, Ford, Gross, nor Wilson, considered alone or in combination, describes or suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers and further determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$. Rather, in contrast to the recitations of Claim 1, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Ford describes a process for determining a baseline vector using carrier observations made at a primary antenna and a secondary antenna, in combination with user-supplied constraints, and Wilson describes using radio wave cycles to exhaustively search for and to identify integer ambiguities. Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Bidaud in view of Ford, in view of Gross, and further in view of Wilson.

Claims 3 and 4 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 3 and 4 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 3 and 4 likewise are patentable over Bidaud in view of Ford, in view of Gross, and further in view of Wilson.

Claim 15 is recited above.

No combination of Bidaud, Ford, Gross, and Wilson, describes nor suggests an apparatus for determining motion and location parameters of a railroad locomotive as is recited in Claim 15. Specifically, none of Bidaud, Ford, Gross, nor Wilson, considered alone or in combination, describes or suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers and further determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and

the vector distance $\vec{\mathbf{d}}$. Rather, in contrast to the recitations of Claim 15, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Ford describes a system that determines a baseline vector using carrier observations made at a primary antenna and a secondary antenna, in combination with user-supplied constraints, and Wilson describes using radio wave cycles to exhaustively search for and to identify integer ambiguities. Accordingly, for at least the reasons set forth above, Claim 15 is submitted to be patentable over Bidaud in view of Ford, in view of Gross, and further in view of Wilson.

Claims 17 and 18 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 17 and 18 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 17 and 18 likewise are patentable over Bidaud in view of Ford, in view of Gross, and further in view of Wilson.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 3, 4, 17, and 18 be withdrawn.

The rejection of Claims 10, 11, and 24-27 under 35 U.S.C. § 103(a) as being unpatentable over Bidaud in view of Ford, in view of Gross, as applied to Claims 1, 5, 15, and 19 above, and further in view of Kumar (U.S. Patent No. 5,896,947) is respectfully traversed.

Bidaud, Ford, and Gross are described above. Kumar describes a method for simultaneously lubricating the rail gage side (RAGS) and wheel flanges ahead of a locomotive's (1) tractive wheels, and lubricating the top of the rail (TOR) behind the tractive wheels to reduce the resistance of the trailing cars and to reduce locomotive wheel flange wear. Kumar describes controlling both lubricating units with the same computer controller (2) when a single locomotive (1) is used, and using two controllers (2F, 2R) located in two different locomotives (1) in the case of a train consist (10). Notably, Kumar does not describe nor suggest determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers and further determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$.

Claim 1 is recited above.

No combination of Bidaud, Ford, Gross and Kumar describes nor suggests a method for determining at least one of motion and location parameters of a railroad locomotive, as is recited in Claim 1. Specifically, no combination of Bidaud, Ford, Gross, and Kumar, describes or suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers and further determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$. Rather, in contrast to the recitations of Claim 1, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Ford describes a process for determining a baseline vector using carrier observations made at a primary antenna and a secondary antenna, in combination with user-supplied constraints, and Kumar describes a method for simultaneously lubricating the rail gage side and wheel flanges ahead of a locomotive's tractive wheels, and lubricating the top of the rail behind the tractive wheels to reduce the resistance of the trailing cars and reduce the locomotive wheel flange wear. Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Bidaud in view of Ford, in view of Gross, and further in view of Kumar.

Claims 10 and 11 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 10 and 11 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 10 and 11 likewise are patentable over Bidaud in view of Ford, in view of Gross, and further in view of Kumar.

Claim 15 is recited above.

No combination of Bidaud, Ford, Gross, and Kumar, describes nor suggests an apparatus for determining motion and location parameters of a railroad locomotive as is recited in Claim 15. Specifically, no combination of Bidaud, Ford, Gross, and Kumar, describes nor suggests a method including determining a vector distance $\vec{\mathbf{d}}$ between two satellite receivers and further determining an accurate heading, accurate heading rate, attitude, and attitude rate of the locomotive during normal locomotive transit operation using

only the set of phase differences between the satellite reference signals and the vector distance $\vec{\mathbf{d}}$. Rather, in contrast to the recitations of Claim 15, Bidaud describes a track analyzer that uses a gyroscope to determine a grade and an elevation of a track, a curvature of the track, a speed of a vehicle relative to the track, a distance the vehicle has traveled along the track, and the direction in which the vehicle is moving, Ford describes a system that determined a baseline vector using carrier observations made at a primary antenna and a secondary antenna, in combination with user-supplied constraints, and Kumar describes a method for simultaneously lubricating the rail gage side and wheel flanges ahead of a locomotive's tractive wheels, and lubricating the top of the rail behind the tractive wheels to reduce the resistance of the trailing cars and reduce the locomotive wheel flange wear. Accordingly, for at least the reasons set forth above, Claim 15 is submitted to be patentable over Bidaud in view of Ford, in view of Gross, and further in view of Kumar.

Claims 24-27 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 24-27 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 24-27 likewise are patentable over Bidaud in view of Ford, in view of Gross, and further in view of Kumar.

For at least the reasons set forth above, Applicants respectfully requests that the Section 103 rejection of Claims 10, 11, and 24-27 be withdrawn.

In addition, Applicants respectfully submit that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. None of Bidaud, Ford, Gross, Wilson, or Kumar, considered alone or in combination, describes or suggests a method for determining motion and location parameters of a railroad locomotive as is recited in the claims of the present application.

Further, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. It appears that the present rejection reflects an impermissible attempt to use the instant claims as a guide or

roadmap in formulating the rejection using impermissible hindsight reconstruction of the invention. Evidence of this hindsight reconstruction is the need to combine five references in order to make the argument that the claims are obvious. The United States Supreme Court has recently expressed concern regarding distortion caused by hindsight bias in an obviousness analysis, and notes that factfinders should be cautious of arguments reliant upon ex post reasoning. See KSR International Co. v. Teleflex, Inc., slip Opinion at page 17. The Supreme Court also explained that, following "common sense," "familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." Id. at page 16. Applicants respectfully submit that the teachings of Bidaud, Ford, Gross. Wilson, and Kumar do not fit together like pieces of a puzzle, but rather are isolated disclosures, which have been chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejection be withdrawn.

In view of the foregoing remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,

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